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HYPEROPIA

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Hyperopia is a condition, where the eye is deficient in refraction power. The refractionist meets this condition more often in his daily practice than any other ocular anomaly. Most authorities on the subject are agreed as to the causes and kinds of hyperopia, but not all agree as to the methods of treatment.

Searching the ophthalmic literature, one may be astonished to find that so little has been written upon so great and important subject. Souther, May Valk, Hartridge, Hansell and Sweet, Laurence, Lockwood, Sheard and others, claim that hyperopia is due to one of three causes:

1. Axial
2. Index
3. Curvature

Axial hyperopia is a condition where there exists a shortening of the axis. This is due ordinarily to a condition of congenital deficiency of the antro-posterior diameter of the eye ball as compared with the average normal diameter. This is the most prevalent type of hyperopia and to it are attributed nearly all cases, unless there is some definite evidence that the defect is due to some other causes. The average axial length of an eye is considered to be 23.2 millimeters. A deficiency of one millimeter accounts for 3D. of defect.

Index hyperopia is due to some perceptible change in the index of the aqueous or vitreous. While the indicies of these media are usually found to be constant still they do at times change. If the indicies of these media should be increased as from the presence of sugar in diabetes, a condition of hyperopia would result. Index hy-

peropia may also result from an equalization of the refractive indicies throughout the crystalline lens, which usually takes place with the increase of age.

Curvature hyperopia is a condition where one or more of the surfaces of the lens is less curved than the average, or where there is a flattening of the curvature of the cornea, thus causing the eye to become hyperopic. This type is not found very frequently.

Varieties of Hyperopia

It is also accepted by most writers on the subject that there are several types of hyperopia, namely:

1. Manifest
   (a) Facultative
   (b) Relative
   (c) Absolute
2. Latent

Manifest hyperopia is a condition in which the visual acuity of the eye is normal with or without the aid of any convex lens and is measured by some with the strongest convex lens which may be placed in the front of the eye and still retain normal vision. This method of testing the manifest hyperopia is not correct, we contend, because of several important factors, which have a direct bearing upon the findings of this test, are not given any consideration, namely the differences in the test charts, the variation of the amount of illumination, the size of the pupil, and the personal equation—the development and keenness of the individual's judgment, all these have some bearing on the findings of the manifest refraction and may account to a great extent for the difference between the manifest and cycloplegic finding arrived at by many practitioners.

Facultative hyperopia is much the same as manifest and the same methods are being employed to measure the amount present. As a matter of fact, Landholdt called this condition "facultative manifest hyperopia."

Relative hyperopia is a condition where one can see clearly only by converging the visual axis to a point much nearer than the object. In this case clear vision is gained at a cost of losing binocularity.

Absolute hyperopia is a condition where the accommodative apparatus can not control the parallel rays, or which has lost its power to bring them to a focus on the retina. Vision for distance in a case like this is poor and is dependent upon the convex lenses with the aid of which vision can in most cases be brought up to normal.

Latent hyperopia is claimed to be a condition in which part of the defect is concealed by the accommodative apparatus and can be uncovered only as some authorities contend, by the use of a cycloplegic.

While the causes of hyperopia and the varieties as outlined in these pages are generally accepted by most writers, the method of

treatment still remains a subject for discussion. One school of refractionists maintains that a cycloplegic is an absoltue necessity if correct results are to be derived from the examination and another school contends that correct results can be obtained without its use. The advocates of the use of cycloplegics in refraction have not supplied sufficient facts to prove their contention, hence it still all remains to be an unproved theory. The writer contends that refraction in general and hyperopia in particular can be more accurately treated by using a proper "optometric technic" instead of a cycloplegic. Optometric methods of examination when properly applied will produce correct results. To prove this contention the writer conducted a series of experiments consisting of the examining of a number of persons *with* and *without the use of a cycloplegic* AND THE RESULTS CLEARLY PROVE THE CONTENTION.

Before presenting the facts and figures of the experiment, it may be of interest to review briefly some of the ophthalmic literature and bring out some of the views held on the subject. Upon searching the literature, we find that some of the accepted authorities pass up the subject by merely stating that a cycloplegic should be used in all cases with the exception of people of over 40 years of age. Others make no mention of it at all. Dr. De Schweinitz has this to say on the subject ("Diseases of the Eye," De Schweinitz, p. 135): "In addition to the medicinal value of midriatics in the treatment of diseases of the eye, e. g., iritis, these drugs are employed as aids of an accurate determination of ametropia. With the ophthalmometer with the aid of midriatic, and with the methods of retinoscopy in the absence of prolonged mydriasis, good results, are obtained; but it is a safe rule in all cases of suitable age, and in the absence of contra indicating symptoms, to employ a mydriatic before attempting to select correcting lenses. This remark applies particularly to cases of astigmatic errors. The mydriatic accomplishes three purposes:

"(a) It dilates the pupil, and permits a thorough exploration of the interior of the eye.

"(b) It paralyzes the actions of the ciliary muscle and places the accommodation in abeyance, rendering manifest types of ametropia, which otherwise would remain latent.

"(c) It fulfills the important function of giving, during the time of its action, physiological rest to the eye that is under its influence and consequently helps to subdue any retinochoroidal disturbance or other congestive condition that preexisting eye-strain may have originated."

Ball ("Modern Ophthalmology," p. 132) claims that "Mydriatics are used for four purposes: (1) to dilate the pupil and thus permit the examination with the ophthalmoscope; (2) To paralyze the accommodation and thus permit the observer to measure the refraction by some methods which can be employed only when the ciliary muscle is made inactive; (3) To determine the diagnosis of 'eye-strain,'

and (4) they are employed as therapeutic agents in inflammation particularly those of the uveal tract."

Drs. Hansell and Sweet ("Diseases of the Eye," p. 84) have this to say on the subject: "Optical Treatment: (1) Latent—Under cycloplegia the absolute hyperopia is determined and proved by the usual tests. The final estimation is by the method of the test lenses and test cards. The lens that gives full visual acuity is the measure of the total hyperopia. The patient is asked to read the smallest letters on the test card that he can decipher at six meters distance from one eye, the other being excluded from the act of vision. A convex glass, determined approximately (or exactly) by other tests, is placed in the frame and the effect on vision noted. This glass is modified if necessary until no further improvement in vision can be made. Astigmatism, an important factor in the majority of cases of hyperopia, will prevent full sharpness of sight through spherical lenses. It must be corrected or excluded in every case. In general full correction is ordered (a) only when the hyperopia is low and the glass is desired for close work. Exceptionally it should be recommended for constant wear, particularly in inflammation or congestion of the uveal tract. (b) When the symptoms are severe and full test of the accommodation is essential for comfort.

"Latent and Manifest: The accommodation must be paralyzed, and the adaption and ordering of glasses carried on as described above. As a rule glasses for constant wear will be needed or one pair for distance (less than full correction) and one for near (full correction) are needed.

"Absolute: No cyclopegia is required. The full correction should always be ordered for distant wear, with the addition of the presbyopic glass for near.

"It is customary in the majority of cases in which the refraction is estimated under cycloplegia to postpone the ordering of the glasses until accommodation has returned. The full correction can then be modified for the purposes for which the glasses are needed. In low defects postponement is unnecessary, and the glasses can be ordered as soon as determined. The objection to a full correction of high hyperopia by patients is a real and practical one. They decline to wear glasses that obscure the vision, and thus the therapeutic value of glasses is lost."

The experiment carried out by the writer consisted in making a retinoscopic and subjective trial lens examination under a static condition which was considered as the manifest refraction and a retinoscopic and subjective (trial lens) examination while the eyes were under a cycloplegic.

Material Used

This examination was made on men only, the age ranging from eighteen years and over. It was a strong, healthy group of soldiers

who presented themselves for refraction at the U. S. Base Hospital. There were 65 persons refracted under this experiment. The cycloplegic used was a mixture of homoatrophine and cocaine. A thorough check was made in each case to make certain that there was complete paralysis of accommodation.

TABLE NO. 1

Cases where the manifest retinoscopy was found to be the same as the cycloplegic retinoscopy.

+ 25 Sph. to + 1.00 Sph.	24 eyes
+ 1.25 Sph. to + 2.00 Sph.	2 "
+ 2.25 Sph. to + 4.00 Sph.	3 "
+ 4.00 Sph. to + 6.00 Sph.	3 "
Total	32 eyes

TABLE NO. 2

Cases where the cycloplegic retinoscopy was greater than manifest retinoscopy.

Cycloplegic retinoscopy	+ 25 Sph. greater	8	eyes
" "	+ 50 Sph. "	8	"
" "	+ 75 to + 1.00 Sph. "	8	"
" "	+ 1.25 to + 2.00 Sph. "	4	"
" "	+ 2.25 to + 4.00 Sph. "	3	"
" "	+ 4.25 to + 6.00 Sph. "	1	"
Total		32	eyes

TABLE NO. 3

Cases where manifest retinoscopy was greater than cycloplegic retinoscopy.

Manifest retinoscopy	+ 50 Sph. greater	12	eyes
" "	+ 25 Sph. "	3	"
" "	+ 75 to + 1.00 Sph. "	1	"
" "	+ 1.25 to + 2.00 Sph. "	0	"
" "	+ 2.25 to + 4.00 Sph. "	0	"
" "	+ 4.25 to + 6.00 Sph. "	0	"
Total		16	eyes

TABLE NO. 4

Cases where subjective findings under cycloplegic were the same as manifest subjectives.

+ 25 to + 1.00 Sph.	cycloplegic subjective same as manifest subjective:	34	eyes
+ 1.25 to + 2.00 Sph.	" " " " " "	2	"
+ 2.25 to + 4.00 Sph.	" " " " " "	2	"
+ 4.25 to + 6.00 Sph.	" " " " " "	1	"
Total		39	eyes

TABLE NO. 5

Cases where cycloplegic subjective findings were greater than manifest subjective findings.

Cycloplegic subjective				+	25 Sph.	greater	than	manifest	subjective	 17	eyes
"	"			+	50 Sph.	"	"	"	"	 8	"
"	"	+	75 to	+	1.00 Sph.	"	"	"	"	 7	"
"	"	+	1.25 to	+	2.00 Sph.	"	"	"	"	 2	"
"	"	+	2.25 to	+	4.00 Sph.	"	"	"	"	 6	"
"	"	+	4.25 to	+	6.00 Sph.	"	"	"	"	 0	"
Total										 40	eyes

TABLE NO. 6

Cases where manifest subjective findings were greater than cycloplegic subjective findings.

Manifest subjective				+	25 Sph.	greater	than	cycloplegic	subjective	 7	eyes
"	"			+	50 Sph.	"	"	"	"	 0	"
"	"	+	75 to	+	1.00 Sph.	"	"	"	"	 0	"
"	"	+	1.25 to	+	2.00 Sph.	"	"	"	"	 0	"
"	"	+	2.25 to	+	4.00 Sph.	"	"	"	"	 0	"
"	"	+	4.25 to	+	6.00 Sph.	"	"	"	"	 0	"
Total										 7	eyes

Results

of the 130 single eyes refracted the results given in the accompanying tables were found. A study of Tables 1 and 2 will show that the number of eyes where the cycloplegic retinoscopic findings were the same as in the manifest, is exactly equal to the number where there was some difference between the manifest and cycloplegic retinoscopic findings. If we should transfer the first groups of Table 2 where the difference in the findings of eight eyes is only a + 25 Sph. which ordinarily we would be justified in considering these under Table 1 where the findings in each case are equal, we would then have 40 eyes where the Sph. findings under manifest and cycloplegic retinoscopy, are the same as against 24 eyes where the cycloplegic findings were greater than the manifest.

A study of Tables 2 and 3 will show that there were just half as many cases where the manifest retinoscopic findings were greater than the cycloplegic findings, when compared with those of Table 2 where the cycloplegic findings were greater than the manifest.

A study of Tables 4 and 5 will show that the number of cases where the cycloplegic subjective findings are the same as the manifest subjective is nearly equal to numbers of cases where the findings differed. If we should transfer the first group of Table 5 where the difference of 17 cases is only + 25 Sph., which ordinarily we would be justified in considering these under Table 4 where the findings in each case are the same, because the patient's judgment, it has been found by the writer, is not reliable on that small amount. We would then have 56 cases where the findings are the same under either test as against 23 cases where there was some difference in the findings.

TABLE NO. 7

Cases where the retinoscopic and subjective findings were the same under cycloplegic.

+	.25	to	+	1.00	Sph.	cycloplegic	retinoscopy	same	as	cycloplegic	subjective	 19	eyes
+	1.25	to	+	2.00	Sph.	"	"	"	"	"	"	 2	"
+	2.25	to	+	4.00	Sph.	"	"	"	"	"	"	 3	"
+	4.25	to	+	6.00	Sph.	"	"	"	"	"	"	 0	"
					Total							24	eyes

TABLE NO. 8

Cases where cycloplegic retinoscopic findings were greater than the subjective.

Cycloplegic	retinoscopy					+	.25	Sph.	greater	cycloplegic	subjective	17	eyes
"	"					+	.50	Sph.	"	"	"	16	"
"	"	+	.75	to	+	1.00	Sph.	"	"	"	"	10	"
"	"	+	1.25	to	+	2.00	Sph.	"	"	"	"	 3	"
"	"	+	2.25	to	+	4.00	Sph.	"	"	"	"	 1	"
"	"	+	4.25	to	+	5.00	Sph.	"	"	"	"	 0	"
					Total							47	eyes

TABLE NO. 9

Cases where the findings of the manifest retinoscopy were the same as the manifest subjective.

+	.25	to	+	1.00	Sph.	manifest	retinoscopy	same	as	manifest	subjective	28	eyes
+	1.25	to	+	2.00	Sph.	"	"	"	"	"	"	 2	"
+	2.25	to	+	4.00	Sph.	"	"	"	"	"	"	 0	"
+	4.25	to	+	6.00	Sph.	"	"	"	"	"	"	 0	"
					Total							30	eyes

TABLE NO. 10

Cases where the manifest retinoscopy findings were greater than the manifest subjective findings.

Manifest	retinoscopy					+	.25	Sph.	greater	than	static subjective	16	eyes
"	"					+	.50	Sph.	"	"	"	11	"
"	"	+	.75	to	+	1.00	Sph.	"	"	"	"	 7	"
"	"	+	1.25	to	+	2.00	Sph.	"	"	"	"	10	"
"	"	+	2.25	to	+	4.00	Sph.	"	"	"	"	 2	"
"	"	+	4.25	to	+	6.00	Sph.	"	"	"	"	 0	"
					Total							46	eyes

A study of Tables 7 and 9 will reveal that the retinoscopic and subjective manifest findings are the same, in a greater number of cases than the retinoscopic and subjective findings under the cycloplegic. Also Tables 8 and 10 show that there are just as many cases where the retinoscopic and subjective spherical findings vary under a cycloplegic examination as those under a manifest examination. In astigmatic cases the cycloplegic and noncycloplegic findings are similar to the hyperopic findings as given in the tables of the preceding pages.

The value of the use of cycloplegia in refraction work can further be shown by a study of some cases from the writer's own practice,

which were refracted under a cycloplegic and without the use of a cycloplegic and the results obtained will help prove the writer's contention that a cycloplegic is not at all necessary and in many cases not desirable.

Illustrative Cases

Case 1. Patient female, age 31, office clerk by occupation, presented herself for refraction on November 6, 1923, complained of frontal pains, photophobia, lachrimation, diplopia. Also claimed to get blind spells lasting for two and three days a week. Patient was refracted five times during the last three years, by different refractionists, a cycloplegic having been used each time. The last refraction was made a few months ago by a reputable ophthalmologist, a personal friend of the writer. It was the writer's privilege to refract many cases together with this ophthalmologist in the eye department of one of the Base Hospitals during the war, and the writer has found him to be a thorough and painstaking refractionist. The patient was wearing, at the time she called for a refraction, O. D. + 1.00 D. Cyl. axis 180; O. S. + 4.00 D. Cyl. axis 135. Visual acuity without lenses was O. D. 10/200; O. S. 20/200. Retinoscopic findings were O. D. —13.00 D. Sph. O. S. —6.00 D. Sph. ⌣ —4.00 D. Cyl. axis 165. Visual acuity with these findings was O. D. 20/30, O. S. 20/25—. The following lenses were prescribed: O. D. —9.00 D. Sph.; O. S. —7.50 D. Sph. ⌣ + 3.50 D. Cyl. axis 75. After wearing this prescription for a while, the patient reported that all symptoms complained of before disappeared and that she was feeling fine. The patient was under observation for four months' time and the same satisfactory report was given each time the patient called for re-examination.

Case 2. Patient male, age 14, high school student, called October 22, 1923. Patient is a picture of health in every respect, seems to be unusually strong and well developed for his age. He is five feet three inches tall and weighs 150 pounds. His complaint was that after using his eyes for a few minutes, he became very nervous and developed ocular pains. He was refracted six months ago under a cycloplegic and was prescribed O. D. —0.75 D. Cyl. axis 90; O. S. —1.00 D. Cyl. axis 90.

Patient's vision without lenses was O. D. 20/30; O. S. 20/40; a—1.00 D. Cyl. axis 90; O. U. gave 20/20 vision. The findings of the ophthalmoscope, of the external ocular examinations and of static retinoscopy, were all negative. Ophthalmometer findings, O. D. 0.75 axis 90; O. S. 0.25 axis 90.

Tonicity test showed no vertical imbalance either at distance or at near but an esophoria of 12 degrees at a distance and 13 degrees at near. Dynamic skiametry developed O. U. + 1.50 D. Sph. ⌣ + 1.50 D. Cyl. axis 180. The patient was given O. U. + 0.75 D. Sph. with instruction that glasses be worn constantly for three weeks and return for a re-examination at that time. A re-examination revealed that the visual acuity with the naked eye had improved and there was also a

decrease in the amount of esophoria. The case was continued under observation and suppression lenses given each time when so indicated by the examination. To date the patient is still wearing a plus correction and is perfectly comfortable, all annoying symptoms having disappeared upon removal of minus correction which was given under the use of a cycloplegic.

Case 3. Patient male, age 18, on October 5, 1919, came to me complaining of an inability to use his eyes for close work. Upon examination, under a manifest static and dynamic retinoscopy, the patient was prescribed + 1.50 D. Sph. for constant use. The patient reported within four weeks that he could use his eyes for any length of time with complete comfort. About a year later, the patient called at the office and complained of the same trouble he had last year, stating that a couple of months before he had lost his glasses while in another city. He had his eyes refracted there under a mydriatic but did not feel comfortable with the last pair of glasses, upon neutralizing his lenses it was found that he was wearing + 75 D. Sph. O. U. The patient was refracted and we found no material change in the findings since our examination of October 1919. The patient was again given + 1.50 D. Sph., O. U., which gave him comfort. Here again is seen a case where under a cycploplegic examination has been prescribed just one-half of the amount of plus spherical correction compared with the prescription given under an examination without the use of cycloplegics.

Case 4. Patient S., male, age 56, office executive, called for examination May, 1925. He complained that his eyes felt uncomfortable, especially when used for near work. He was refracted under a cycloplegic by an ophthalmologist four months ago who prescribed O. D. + 0.50 D. Sph.; O. S. + 0.25 D. Sph. added for near O. D. + 2.50 D. Sph. O. S. + 2.25 D. Sph. the writer's examination revealed static retinoscopy O. D. + 1.50 D. Sph. O. S. + 1.25 D. Sph. Dynamic retinoscopy O. D. + 3.50 D. Sph., O. S. + 3.25 D. Sph., 4 P. D. of esophoria at distance and 6 P. D. to 10 P. D. of esophoria at near, also 2 P. D. of right hypophoria. The static and dynamic retinoscopic findings were prescribed in bifocal form and a 1½ P. D. prism base up and down equally divided between the two eyes was incorporated. After wearing this prescription for one month the patient reported relieved of his former symptoms.

Case 5. Mrs. A, age 40, called for examination in September, 1924. She complained of severe headaches, inability to use her eyes at all for near point work with or without her glasses. Had insomnia for the last 14 months. The glasses she wore at that time were prescribed a year previous by an ophthalmologist, who enjoys a considerable reputation. He was a colonel of the U. S. Army medical corps during the World War and has lectured on some occasions at the section of ophthalmology of the American Medical Association and is also a frequent contributor to the national ophthalmological publications. The glasses he prescribed neutralized O. D. + 0.75 D. S. ⊃ + 1.00

D. Cyl. axis 90; O. S. + 0.75 D. S. ⊃ + 0.75 D. Cyl. axis 90. Add for near O. U. + 1.00 D. Sph. The writer's examination revealed static retinoscopy, O. D. + 4.00 D. Sph. O. S. + 3.75 D. Sph. Dynamic retinoscopy O. U. + 5.00 D. Sph. The patient was under the writer's care for several months and the final prescription was for the distance and near O. D. + 3.75 Sph. O. S. + 3.50 D. Sph. She will no doubt be able to accept, later on, a still stronger plus correction approaching the dynamic findings. The patient was pleased with the last prescription because she could see well, felt comfortable and could sleep again.

Use of Cycloplegic Explained From a Psychologic Standpoint

Why are some refractionists at an absolute loss when refracting without the use of a cycloplegic? This condition is due to two facts: (1) The lack of training in making a thorough refraction by any other method. (2) Using a cycloplegic in refraction for any length of time one becomes adapted to this method and misses the cycloplegic findings when one has to refract and use the manifest findings.

The same is equally true when any refractionist has to omit any one of the tests he has been used to perform while making a complete refraction. There are some refractionists who claim that they would dispense with any instrument while making refraction, but the retinoscope, or ophthalmoscope, or ophthalmometer and the use of any one of these instruments is just of as much importance to these refractionists from the standpoint of obtaining information, as is the use of cycloplegics to others. That the law of adaptation is an important factor in the continued use of cycloplegics can be testified by the writer not merely from the observation and experience of other refractionists, but from his own personal experience as well. At one time the writer was so situated that he made a general use of cycloplegic in his refraction. Later on he became so adapted to the use of cycloplegics that he felt that his refraction was not complete without the cycloplegic findings. This is true, not only in the writer's personal experience, but with other refractionists as well. Some time ago the writer had an opportunity to come in close contact with many refractionists, who were constant users of cycloplegics and he found that these refractionists were helpless when they tried to refract without using a cycloplegic. Most of them could not make a thorough and reliable manifest refraction. In most cases the manifest refraction consisted of merely taking the visual acuity before using the cycloplegic. The writer agrees with Dr. E. M. Alger, who states that he was "sorry to see the growing dependence on cycloplegics; not that they were not often necessary, for they were, but in many cases the patient's actual needs could be better served without them. They often obscured vital elements in the problem and sometimes seemed to paralyze the initiative of the physician even more than they did the accommodation of the patient. They should be omitted or used according to the needs of the individual case."

The advocates of using cycloplegics in refraction, completely overlook the importance of the size of the pupil. The findings vary in most cases as the size of the pupil changes. Under the influence of a cycloplegic, the pupil is greatly enlarged and this naturally will give a different set of findings than the manifest refraction, when the pupil is of a different size functioning under normal conditions. The change in size of the pupil accounts in most cases for the disagreement of the findings between the manifest and cycloplegic refraction and not the change of the condition of the ciliary muscle under the influence of the cycloplegic.

In carrying on this experiment and drawing the conclusions, the writer has not been influenced by any theoretical considerations advanced on this subject. The conclusions were drawn from the facts and figures as found from actual experience in conducting the examinations under the two different methods of refraction—the cycloplegic and manifest.

A close study of the figures presented in tables 1 to 10, inclusive. will lead any unbiased observer to the following conclusions:

1. That there is more disagreement between the retinoscope and subjective findings under a cyclopegic refraction, than there are found in the same kind of a test used in refractions without a cycloplegic.

2. That the findings of a cycloplegic refraction are no more accurate than those of a manifest refraction.

3. That in most cases accurate findings are obtained in a manifest refraction than in a cycloplegic refraction.

Now that the use of a cycloplegic in refraction of hyperopic cases is found to be unnecessary and undesirable as the results of this experiment indicate the optometric method for the diagnosing and treatment of these hyperopic cases seem to be the most logical as well as the most accurate, provided the proper technic is applied.

Suggested Optometric Technic for Treating Hyperopia

1. A complete and accurate static retinoscopic test.

2. A complete and accurate dynamic retinoscopic test.

3. When static retinoscopic findings are not clear cut and definite, prisms base-in, should be used in the test until satisfactory findings are obtained.

4. When the static retinoscopic findings are much greater than the strongest plus lens, the patient can possibly accept without having his vision greatly reduced, it is advisable to give as much plus as possible and institute prism treatment to force the convergence to relax its control over accommodation. The amount of plus should be gradually increased as soon as there is an improvement in the visual acuity.

5. When static retinoscopy gives a neutral shadow or a small amount of myopia, while the dynamic retinoscopy reveals a considerable amount of hyperopia accompanied with an esophoria in the distance and near, reduce the minus correction even to a point where the visual acuity is reduced or if possible eliminate the minus correction entirely and prescribe prism base-in. The amount of prism prescribed should be slightly less than the amount which would produce diplopia. This is to be supplemented with prism and myoculator treatment. Also some form of treatment should be used to develop the visual acuity. In some cases it is advisable to prescribe extra lenses for near adding some plus to the prisms.

6. In cases of hyperopia, where amblyopia in one or both eyes is present, treatments should be instituted to develop the vision in the amblyopic eye. In most cases, the treatments for amblyopia produce satisfactory results.

7. If there is found an existing exophoria in the distance or near the amount of plus lens prescribed should be such that will not increase the exophoria.

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A BLOOD PRESSURE CHART FOR OPTOMETRISTS

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The significance of blood pressure readings in optometry has been spoken of too well and too often to merit repetition. Some optometrists make blood pressure tests themselves, and rely upon them strongly in their diagnosis. Others appreciate the value of abnormal blood pressure indications but by their experiences have learned to recognize their presence by the allied symptoms the patient exhibits. This procedure, though perhaps effective enough in the majority of cases, means only an acquired knowledge of the subject that will not allow a very intelligent understanding of any detailed diagnosis that may be made by someone particularly adept in this work, particularly in those instances when patients have been referred to physicians and other specialists, and then returned to the optometrist. Yet, the whole subject can be broadly understood on the basis of what might be termed a "what should be" epitome of things. Thus, if a patient at 44 has a systolic reading of 155 or 160, he is liable to offer a complaint, because, as the optometrist should know, or should be able to find out by ready reference, his reading around this age should be 140 or so.

Based on the findings compiled from thousands of cases in hospitals and clinics throughout the country, I have performed the physical operation of plotting these findings into a chart that should serve optometrists as a composite and ready reference he might keep on hand, to determine at a glance what the systolic and diastolic ranges should be at any age.

Chart of Normal Blood Pressures at Various Ages

Range of Ages	*Systolic Range*			*Diastolic Range*		
	Max.	*Aver.*	*Min.*	*Max.*	*Aver.*	*Min.*
15 to 19	131	119	107	89	85	81
20 to 24	134	122	110	91	87	83
25 to 29	135	123	110	91	87	83
30 to 34	136	124	110	93	89	85
35 to 39	137	126	112	94	90	86
40 to 44	140	127	114	97	92	87
45 to 49	142	129	116	97	92	87
50 to 54	144	132	119	100	94	89
55 to 59	144	135	120	105	100	95
60 to 64	145	137	121	106	101	96

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THE TOXEMIC THEORY OF DISEASE

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Toxemia is a word used to describe a condition of the human body in which poisons or waste matter, called toxins, accumulate in amounts sufficient to bring about disease of one kind or another. Under the ordinary and normal conditions of health, and as long as the central sympathetic nerve power is strong enough to maintain a balanced metabolism, waste matter, or toxin, does not accumulate in excess of physiological limits, and we are said to be free from disease. However, when the central nerve power is weakened from any cause, and the secretions are lessened because the cells fail to cast off the waste matter and the used up nutriment, toxin is retained in the system, causing what is called toxemia.

It must not be thought that the toxins or waste matters which constitute the condition known as toxemia are any other than the natural products of that process of nutrition and repair called metabolism. As long as toxins are produced in normal amounts, and as long as they are excreted from the system as fast as they are secreted, toxemia can not be said to exist. Only when the system becomes enervated through overwork; through worry, fear, anger, grief, ill-temper, passion, dissipation, improper and imprudent eating, wrong food combination, through stimulants, such as coffee, tea, and tobacco, or through any other weakening cause, is it possible for toxins to be retained in the blood and bring about the condition known as toxemia.

It must be remembered, in this connection, that, as enervation progresses, toxemia accumulates and increases, so that the more profound the enervation, the greater the toxemia. Now, since toxemia is made up of toxins and poisons, and since these are inimical to life, the greater the toxemia, the more profound the enervation. We have here the work and the example of a vicious circle. For instance, a toxemic patient is always an enervated one; and the more deeply enervated a patient becomes, the more rapidly will he accumulate toxemia. This process of reciprocal aggravation, so to speak, may proceed until the patient is so literally and thoroughly saturated with toxic matter that he is constantly in danger of succumbing to some acute or subacute affection. In fact, he is never well; and if he is

honest with himself, he will admit that he never feels really well. The only thing which saves him from going into organic disease, or into a premature and early demise, is what is known as a crisis, which acts as a safety valve, so to speak, to his retained secretions and excretions.

The word "crisis" is used in medical terminology to describe a change in a disease, commonly known as the turning point, indicating whether the disease is getting better or growing worse. In reality, however, a crisis is nature's effort at relieving the system of the accumulated waste matter or toxins—in other words, at establishing vicarious elimination. From our point of view, therefore, every so-called disease is a crisis in the course of toxemia, which is the real and fundamental basis of all disease. It is not merely a change in the course of a single disease, as medical nomenclature would regard it. A cold in the head, for instance, a hay fever, a bronchitis, a bronchial asthma, a pneumonia, a colitis, or any excessive discharge from a mucous membrane, whether such be in the nose, throat, bronchial tubes, uterus, bladder, or large bowel—all these are so-called crises occurring in individuals saturated with toxemia. These various diseases and conditions are all forms of vicarious elimination—crises occurring in the course of all diseases—namely, toxemia. Since this is true, it can be understood that the diseases mentioned above spring from one cause, and are not distinct diseases, in the ordinary sense of the word.

What is of special importance to know, in this connection, is the fact that all catarrhs, colds, bronchitis, tonsilitis, "flus," pneumonias, and other pathological conditions of the air passages, are almost always preceded by a catarrh of the stomach and bowels. We are certain that this is true, for the reason that, when the catarrh of the stomach and bowels is made to disappear, the other symptoms or manifestations of disease in other parts of the body disappear at the same time. Toxemia, being the cause of all diseases and of all disease manifestations—first of the stomach, then of the bowels, and subsequently of other parts of the body, such as the nose, throat, and air passages—if not relieved by the right kind of treatment and methods, continues to accumulate until the limit of toleration and resistance is reached, when other diseases begin to appear. Repeated colds, as a rule, end in hay fever or in asthma; and should nature not find a vent to relieve the system of its accumulated toxins through these conditions, other conditions—such as neuritis, rheumatism, pleurisy, peritonitis, Bright's disease, pulmonary tuberculosis, liver diseases, including gall stones, and other so-called disease—will develop.

The type of crisis or disease which any particular individual may develop will depend upon his age, occupation, habits, temperament, hereditary tendency, and predisposition. Those having a tendency, I believe, either through heredity or through occupation or habit, to lung conditions are likely, if toxemic, to develop pulmonary

tuberculosis, or any one of the many so-called diseases that affect the lungs. Those having a tendency to kidney degeneration will, if toxemic, develop one of a number of diseases of the kidneys. Those having a tendency to weakness of the nervous system will, if toxemic, develop some condition peculiar to the brain or central nervous system. In each and every individual, the type of disease or the kind of crisis is determined by the tendency, habit, and predisposition; the substance of the disease—that is, I believe, the thing which brings it on, being always some form of toxemia. The converse of this rule also holds good, in my belief, and may be stated as follows: Those having a hereditary tendency or predisposition to disease can never develop it if they are not toxemic. Where there is no toxemia, I claim there can be no disease—predisposition and heredity to the contrary notwithstanding.

Diversity in the type of disease is not only brought about by predisposition, heredity, and environment, but frequently by the anatomical character of the tissue, or the point at which nature undertakes to eliminate toxins. Thus, for instance, repeated occurrences of catarrh of the nose, throat, and bronchial tubes leads to thickening of the mucous membrane of these organs, bringing about chronic thickening, adenoids, polypi, and other growths. The same thing applies to conditions in the stomach and bowels, where repeated attacks of simple catarrh lead to congestion; and congestion leads to inflammatory thickening, then to ulceration, and, I believe, probably finally to cancer.

Diversity in the type of disease is also brought about by nature's use of a larger area for eliminating toxins, rather than by concentration of her efforts at some localized point or area, as described above. This she accomplishes by making use of the continuity of surface of the various membranes of the body. Some of the best illustrations of this process of elimination over an increased area of tissue are seen in the cases of colitis following catarrh of the stomach, pharyngitis, rhinitis, and cholecystitis, and the formation of gall stones following this condition. Gall stones usually begin in a simple catarrh of the stomach, which spreads into the duodenum, and from the duodenum through the bile-duct into the gall-bladder, where, in toxemic subjects predisposed to gout and rheumatic conditions, gall stones are gradually formed. But whether nature uses a larger area in one than in another for eliminating the toxic waste matter from the system, the fact remains that the various crises—such as colds, hay fever, tonsilitis, asthma, and other diseases, are, I believe, so many safety valves which permit the patient to continue to live under enervating and disease producing habits with as little danger to himself as possible.

We see here an example of nature's intelligent efforts at a compromise; for the extension of a chronic catarrh of the stomach to the nose, the throat, the bronchial tubes, or the colon relieves the condition of the stomach, while at the same time it may prevent a danger-

ous ulceration or a fatal cancer. This method of vicarious elimination on the part of the powers of nature can be understood only in the light of the theory of toxemia. The medical text books of the day say little or nothing about it, notwithstanding the fact that I believe this to be the only rational explanation of all the phenomena of disease. With toxemia as a basis in treating disease, there is a clarity of vision and perspicacity of understanding; without it, there is doubt, hesitation, uncertainty, and failure.

In order to illustrate what is meant by "vicarious elimination," I wish to recall a case of a lady who had been suffering for many years with arthritis. Many years ago, so she said, she was afflicted with catarrh of the stomach. Following this, there was a history of alternate diarrhea and constipation, which finally terminated in obstinate constipation. Then came frequent colds in the head, which, not being relieved in the right way by getting rid of toxemia through the elimination of bad habits of living and eating, developed into hay fever and asthma. These latter conditions persisted a long time, and, not being understood as the manifestations of a general catarrhal condition brought on by toxemia from enervation, and other wrong and imprudent habits of living and eating, were treated by the usual palliative methods, only to end in subacute rheumatism, and finally arthritis. Had the resistance of this patient not been broken down so rapidly, or had nature established a vent by eliminating excessive toxin through the mucous membranes of some other organs—say, the uterus—she might have been saved from her hay fever and bronchial asthma. If not sufficient waste matter could have been eliminated through the uterus to offset her bad and imprudent habits of living, the bronchial asthma would probably not have been much relieved, but I believe the arthritis would never have made its appearance. The various crises of toxemia, called "diseases" in medical terminology and nomenclature, are I believe, in reality, blessings in disguise, especially when they occur in individuals who are transgressing the physiological laws of their organisms, and who do not know or care enough to reform their habits of dissipation, enervation, gourmandizing, and excess.

Nature is not so cruel as some suppose, but very generous, lenient, and indulgent; for she makes every attempt to save the species by saving the individual. We see this fact well illustrated in the theory of toxemia; for nature uses every possible way and means at her command to eliminate the consequence of our ignorant, our foolish, our enervating, and our law-breaking habits. In our willfulness and ignorance we do not regard her methods as beneficent and life-saving, but we look upon them as independent hardships, arising not in the course of an evolutionary process of cause and effect, but as results of the happening of some extraneous or fortuitous event, having in reality no connection with our daily habits of living and thinking. That diseases—crises of toxemia—arise from fortuitous and accidental causes is the view that is still held and taught by a

gullible public who are only too glad to be relieved of personal responsibilty for the disagreeable sensations and perversions which they bring upon themselves.

It is well for us to inquire at this point what in reality is the nature of toxins. Toxins may be said to be all substances, whether introduced into the body from without or generated within, which have an uncongenial and deleterious effect on the tissues, and which are incompatible with the health and the function of one or more, or all of the organs of the body. Those introduced from without are found in tobacco, tea, coffee, alcohol, drugs, ferments and ptomains coming from decomposing food in the gastro-intestinal tract, and other substances formed as secretion or excretion products of vegetables and animal organisms.

Those formed in the tissues of the body itself are of a proteid nature, and may be considered to belong to two general classes—the uric acid series, causing irritation, nerve tension, pain, fever, etc., and the lethal class, causing stupor, subnormal temperature, and coma. In the last state of diabetes, for instance, when the formation of uric acid ceases, this class of toxins begins to form, and causes coma and death.

But no matter how diverse the symptoms may be, I believe, it is always a toxin of some kind or another which is the factor in the production of all pathologic symptoms and phenomena. In fact, the toxin is the principal thing in all diseases, as we have seen above. Those that form within the system—in the blood and in the tissues—are chemically composed of carbon, hydrogen, nitrogen, and oxygen, in various proportions, and they differ from each other according as the proportions differ. Seventy-five or more distinct toxins have already been discovered in the human system—all composed of these elements. The toxic element is the main thing in all kinds of disease conditions, especially in the chronic diseases and in all forms of enervation. Elimination and building up nerve power is the greatest work we have to do.

If we know just how much work the human body is capable of doing under certain circumstances, what proportion of foods is absorbable into the blood under such circumstances and what can be built up into the tissue; and if we could eat just that amount and no more, there would then be no danger of building up toxemia; and the greater work of elimination which the glands and other organs of the body are forced to perform would not be necessary. However, in spite of our ignorance of such definite details, the philosophy of toxemia gives us a practical knowledge by which we not only get rid of our diseases, but can retain good health after we have once got it.

The toxemic theory presupposes the fundamental unity of all diseases. In fact, there is really only one disease, which shows itself under a thousand and one different forms. These forms are so many crises of toxemia. There can be no objection, of course, if people

want to classify such crises according to the organs and systems of organs in which they make their appearance; but for all useful and curative purposes, the idea of the fundamental unity of all diseases, and the practical application of this unity in the treatment of the sick must be constantly kept in mind if success is to be attained. The failure, I believe, on the part of scientific medicine to understand that the toxin-poisoning theory is first, last, and always the fundamental unitary element in all diseases, and that all diseases are merely crises in the course of toxemia, is responsible for the many mistakes committed by the medical profession of today.

Many little ailments, which afflict people from time to time, and which disappear with little or no treatment, lead them into the false idea that such little ailments are of no special consequence, and that, when the discomfort and pain resulting from them are gone, the causes of these ailments are also gone. The truth of the matter is that the cause of such little recurring ailments—whether they are colds, headaches, tonsilitis, indigestion, and so forth—are not removed with the disappearance of their symptoms, for the reason that the condition of the blood upon which they depend has not been removed, but remains latent in the system only to appear at some future time in the form of a more serious and dangerous crisis. I have seen many recurring ailments, seemingly of no special importance, continue over many years and ending not infrequently in heart disease, in rheumatism, in Bright's disease, and in cancer. Such dire conditions could never have resulted if the cause of those little ailments which preceded them had first been removed. Experiences of this kind—showing as they do how recurring ailments and conditions of seemingly minor importance lead to and terminate in all forms of fatal diseases—lead us to conclude that all such conditions must have a fundamental and unitary basis and that such basis consists in what I recognize as toxemia.

Many people are under the impression that they possess good health, notwithstanding the fact that if you inquire into their lives and habits, you will find that they suffer frequently from colds, asthenopia, indigestion, neuritic and rheumatic pains, and other minor ailments. People suffering in this way cannot be considered as having good health; for good health must not only include freedom from the more serious and dangerous diseases—such as Bright's disease, heart diseases, ulcer of the stomach, pneumonia, and similar organic affections—but freedom from all those minor ailments which most people consider of no consequence. Good health, then, which is to be found in freedom from minor ailments and from serious organic diseases, has its basis in a high state of nerve energy and in a pure blood stream free from unusuable nutriment, free from waste matter, free from toxins. Good health is a balancing of the organic functions of the body which, for this purpose, must be supplied by the proper amount of nutriment and the right kind of energy. When this state of being is reached, man is said to be in the full power of resistance and of

immunity to all the adverse influences of his environment. Should he ever become unduly and inordinately subjected to the tremendous pressure of the circumstances and conditions of life in which he lives, he will recover from them very quickly or he may not be influenced by them at all.

A normally healthy man radiates health in all directions. He is muscularly strong, physically fit, and has much self-reliance. As a rule, he is a hard worker and accomplishes much. He is fearless and independent in thought, and courageous, though considerate, in the expressions of his opinions. He is quick and alert in intelligence; strong in will, without being either obstinate or wilful. He enjoys life to the fullest extent, and all things in life. He is pleasant, considerate of the feelings of others, kind-hearted, and has a charm and magnetism all his own. Such are some of the qualities of people having really good health. In their final analysis, these qualities depend upon a fine blood stream, great energy, and freedom from toxemia.

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A FAMILY CASE HISTORY SHOWING HEREDITARY ASTIGMATISM

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A good illustration of the influences of heredity completely combined as in this family is of exceptional interest.

Father, age 39, uses the following correction:

O. D. plus 4.25 D. Cyl. axis 105
O. S. plus 4.25 D. Cyl. axis 80

This gives him a corrected visual acuity of, O. D. 20/40, O. S. 20/40.

Mother, age 35, uses the following correction:

O. D. plus 2.50 D. Cyl. axis 90
O. S. plus 2.25 D. Cyl. axis 90

This gives her a corrected visual acuity of, O. D. 20/33, O. S. 20/33.

Daughter, age 17, uses the following correction:

O. D. minus 0.50 D. Sph. ⊃ plus 4.50 D. Cyl. axis 80
O. S. minus 9.75 D. Sph. ⊃ plus 4.50 D. Cyl. axis 85

This gives her a corrected visual acuity of, O. D. 20/30, O. S. 20/30.

Daughter, age 14, uses the following correction:

O. D. plus 2.25 D. Sph. ⊃ plus 2.00 D. Cyl. axis 90
O. S. plus 2.50 D. Sph. ⊃ plus 2.25 D. Cyl. axis 90

This gives her a corrected visual acuity of, O. D. 20/30, O. S. 20/100.

Son, age 14, uses the following correction:

O. D. plus 2.25 D. Sph. ⊃ plus 2.50 D. Cyl. axis 90
O. S. plus 1.75 D. Sph. ⊃ plus 1.00 D. Cyl. axis 75

This gives him a corrected visual acuity of, O. D. 20/66, O. S. 20/66.

Daughter, age 10, uses the following correction:

O. D. plus 2.00 D. Sph. ⊃ plus 1.50 D. Cyl. axis 90
O. S. plus 1.50 D. Sph. ⊃ plus 0.75 D. Cyl. axis 90

This gives her a corrected visual acuity of, O. D. 20/100, O. S. 20/40.

Following the usual trend of such astigmatic cases the power of the cylinder is increased as the patient grows older. All of these patients have been previously refracted from two to seven times, the history of the father and mother covering a period of twelve years. The fifth child, now about two years old, shows with the skiascope a pronounced hyperopic astigmia, with the rule, and will wear glasses at an early age.

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BLOOD PRESSURE IN RELATION TO HYPERPHORIAS

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For a period of several years I have been keeping records of those cases which I have found to be suffering from hyperphorias and while the results have not been startling I have decided at this time to make known several interesting points that have apparently established themselves due to their repeated occurrence in the majority of cases observed, in the hope that some other optometrist will investigate along the same line.

While associated with Dr. C. H. Johnson* of Philadelphia in 1924 and 1925 we both noticed that in several cases, which happened to be under the care of a physician and were referred to us for refraction, there was manifested a condition of either right or left hyperphoria. Upon conferring with the physician we were informed that these cases were being treated for high blood pressure. We thereupon decided to refer all cases showing a hyperphoria in the future to their physician for an examination and to keep records of the results.

While our intentions had been good and we invariably sent such cases to the physician for physical examination, we did not, however, keep accurate records of the results of these examinations. After repeatedly receiving reports which showed variations in the blood pressure in this type of case I again decided to tabulate and keep these reports. This I have done since January, 1926.

One of the details which we learned quite early in our investigation was that this association of high blood pressure with hyperphoria was confined almost invariably to those of a presbyopic age or as it so happens, rarely occurred in those under 40 years of age. At first my procedure after discovering the hyperopia was to refer the patient to his or her physician, asking them to return to me with a report after the physical examination. Then, if the physician reported normal or only a slight deviation from normal, I would proceed in the usual way to correct this type of case with prisms. However, if the deviation was of considerable proportions and required medical

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treatment, I would prescribe prisms for wear until this treatment was finished. It might be well to mention here that this procedure has been welcomed by the physicians of my vicinity.

Later in my investigations I secured a sphygmomanometer and now take the systolic pressure myself, only referring the case to the physician when this pressure is abnormally high or too low. The basis which I have used to determine the correct or normal systolic pressure has been 100 plus the age. While this may not be the correct index for use in cases under 40 years of age, it has proven to be fairly accurate in the cases which I have been investigating. A variation of ten degrees in either direction from this index may be considered as normal.

The data which I have secured during the past two years and have tabulated has been taken from a total of seventy cases which were over 40 years of age and showed a definite right or left hyperphoria. Of these seventy cases 36 were females and 34 males. I have divided these cases into four classes: Unknown blood pressure, low blood pressure, normal blood pressure, and high blood pressure. There was only one patient whose blood pressure I was unable to secure, therefore, we may say that there are sixty-nine cases divided into three classes. In the low class there were eight cases—three female and five male. In the normal class there were 17 cases—7 female and 10 male, and in the high class 44 cases—25 female and 19 male.

Of this total of 70 cases prisms were prescribed in only 16 cases, four others had the hyperphorias removed by muscle treatments. Several of the cases for whom prisms were prescribed had undergone medicinal treatment for the high or low blood pressure, but the hyperphoria was not completely eliminated. In every case, however, that had undergone treatment for their blood pressure condition there was a corresponding improvement and lessening of the hyperphoria.

While I have not as yet made any real effort to determine whether there is any definite ratio between the degree of hyperphoria and the amount of variation in the blood pressure, it does not seem from the data garnered to date that such is the case. There is no doubt at the present time of the value of a physical examination being suggested in all those cases of presbyopic age who show a definite hyperphoria. Of the seventeen cases whose blood pressure was normal, the physicians discovered in three of these cases ailments of a serious nature which might not have been discovered until too late if it had not been for my requesting a physical examination.

I have mentioned before that I do not believe there is any definite ratio between the amount of the hyperphoria and the amount of variation in the blood pressure. My reason for this belief is that one of the cases observed was a woman 41 years of age who had only 1 degree of left hyperphoria with a systolic pressure of 210. Under the proper treatment this pressure returned to normal and the hyperphoria disappeared. In another case a woman 63 years of age had 2

degrees of right hyperphoria with a systolic pressure of 180. Under treatment the pressure returned to about normal but there still remained 1 degree of the hyperphoria which it was necessary to correct with prisms for comfortable vision.

While as I have said before there does not seem to be any definite conclusions that can be drawn from the data secured so far other than the very important and very definite conclusion that hyperphoria and variations in the blood pressure are in some vague physiologic or pathologic way related to one another. From the data submitted above it can readily be seen that out of a total of 70 cases with a definite hyperphoria, 52 or 74% were afflicted with either high or low blood pressure.

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THE RELIABILITY OF SUBJECTIVE TESTS

Before the advent of static and dynamic skiametry the subjective method of examination was the only means at the command of the examiner for the determination of refractive errors and their correction. With the increased knowledge of skiametry and its application the examiner is placed in a position where he is more or less independent of the subjective test findings. The discrepancy between objective skiametric findings and those of the subjective trial case—"the court of last resort"—as some of our former professors called it, is something that the refractionist has to cope with in order to arrive at a conclusion as to what the proper correction should be.

There has been a tendency in recent years for many examiners to accord the objective findings, from the standpoint of accuracy, a higher place of importance in the routine examination, than the subjective findings. This, we believe, is a good and healthy change, as it makes the refractionist independent of the patient's inaccuracies of judgment. At the same time a number of writers of late have been advocating various new tests which make it imperative for the refractionist to give the subjective tests an important place in his examination and to use these subjective findings in determining what the final prescription should be.

This condition places the question of "the reliability of subjective examinations" before us. To what extent are subjective examinations reliable and accurate? In order to answer this let us first get a clear conception of what constitutes a subjective examination. Lawrence[1] states that subjective sight testing depends on *questions* and *answers:* We learn the symptoms from our patient and he tells us how far down on the test chart he can read and what changes take place in his acuity of vision as the lens, or the combination of lenses is changed. But success in this method of examination depends entirely on the way the questions are put; they must be so absolutely to the point that their answers must guide us to the next step in the test.

A comparison between one lens and another should be made by placing in front of the one in the trial frame a weak + or — lens, as may be needed, preparing the patient for the comparison before the addition is made. It is useless to change one lens for another, immediately stronger or weaker, and then expect the patient to be able to note any very slight visual difference produced.

It is quite remarkable how very sensitive the human eye is to small changes in the incidence of the light entering it. We all know how easily we recognize a change in the size of the retinal image caused by moving a weak spherical to and fro in front of the eye, or the minute change of position of the object viewed, as a weak lens is moved across the line of vision. A subjective test should be made, within reason, as quickly as possible, because the patient's eyes soon become fatigued and then a ready response to altered conditions cannot be obtained. In order to do this, small changes of strength should in our judgment not be tried until near the end of the test when any necessary change must be small. Indeed, it can be safely said that if satisfactory results are not obtained fairly soon, so far as the measurement of the eyes is concerned, it is better to defer the decision as to the lenses required until after a second test has been made on another occasion.

As a quite general rule high refractive errors do not cause painful conditions; it is the low error that does this. The high ones do so only when incorrect lenses are worn and they do so then merely because they are converted by the lenses themselves into low errors.

Another authority[2], discussing the subjective test for astigmatism, states that after he obtains the ophthalmometer and skiascopic findings he proceeds to get the cylindrical correction subjectively as follows: "After correcting the hyperopia and over correcting the astigmatism and locating the correct axis, I then proceed to reduce the cylinder one quarter at a time. The first reduction should slightly clear up the two and four o'clock lines, a further reduction will clear up the one and five o'clock, and a final reduction will leave the three o'clock slightly clearer than the twelve o'clock. I then try adding + 0.50 D. Sph. If this blurs the lines I refer to the letters and increase or decrease the sphere or cylinder one-quarter of a dioptre

as necessary to clear them up. A final slight adjustment of the cylinder usually clears everything up to 100%.

"By following this method, the eye has no opportunity to over accommodate, and much nearer the full latent error can be corrected than by any means which allows regular ciliary contraction.

"In the fogging system, using spheres, and having the patient read the letters, there is every inducement for the ciliary muscles to contract in order to clear up the letters. For instance, the letter E has horizontal and vertical lines. In astigmatism with the rule, with complete relaxation, the vertical lines will stand out clear. However, knowing that the letter is equally distinct throughout, the patient involuntarily contracts the ciliaries in the horizontal meridian to clear up the horizontal lines. This condition persists when looking at the clock dial. However, by overcorrecting the astigmatism and causing the lines in the opposite meridian to stand out clearest, all inducement for irregular ciliary contraction is removed and in a few minutes relaxation results. I have found no better way of breaking up a ciliary cramp and uncovering latent astigmatism than this method.

"Many refractionists when testing for astigmatism subjectively, begin by asking the patient which line or spoke of the wheel looks blackest. Very often this is hard to tell. In some cases the lines apparently keep changing. Often the patient will mention several of the lines. All this is really waste of time. I have often seen a refractionist work from twenty minutes to half an hour trying to locate the axis of a weak cylinder, and then not be able to get the clock dial evened up. This is unnecessary. You know where the axis of the correcting cylinder should be before you ask the patient any questions. By placing it in that position you know that the lines of the opposite meridian will be the clearest. Ask the patient if the lines in that meridian are the clearest. This calls for an answer of either yes or no. This avoids any misunderstanding by the patient as to what you want to know."

It is, as I have already said, generally accepted that the lower optical errors—by this I mean those below 1.00 diopter—are the ones which cause the most trouble and discomfort. They must first be properly found if they are to be corrected. Can these low errors of refraction be accurately determined by a subjective examination? The answer to this question I feel must be given in the negative. I believe this to be true, because the nature and technic of a subjective examination makes the findings largely dependent upon the consultant's judgment which in a great majority of cases is very **unreliable.**

In order to clarify the above statement, let us analyze briefly what is meant by the term judgment, from a psychological standpoint. Ladd[3] claims that judgment is the conscious affirmation of relations of resemblance or difference between the contents of consciousness.

Judgment as defined here enters into all comparison with its process of analysis and synthesis. It is implied in all assimilation and

differentiation so soon as these two terms are employed to denote truly psychical processes.

Another writer explains judgment as an experience that is connected with the consciousness of validity or with a state of assurance, this state is a something though not itself a consciousness of validity, is of such a nature that it brings an affirmative answer to a question. The consciousness of validity appears when, in a course of ideation that proceeds from a suggestion, certain mental processes stand out insistently, force themselves upon the attention.

Titchener[4] thinks judgment as a complex ideational experience, marked by the dual division of attention, which takes shape under the influence of a foregone suggestion; the suggestion, however, may be present not only as an aggregate idea, but as a verbal imagery or as attitude, and it need not be conscious by it being present at all, but may be effective as a cortical set. The attention implied in judgment is always secondary or active attention.

Classes of judgments. "We arrange judgments themselves in classes or groups. All alike in that they refer the material, or situation to be understood, to its class but the classes themselves differ widely. The object may be referred to its class as a thing. Where two things are present that differ in any way, one may compare them as greater or less in each of the respects in which they differ. This judgment of comparison is like the ordinary judgment in that the relation is referred to some typical relation of greater or less value in each respect. Although comparison involves two objects, the comparison itself is a single process and consists in referring the particular difference to some standard difference or typical relation."

Grimshaw[6] in discussing Judgments and Propositions claims that a judgment exists in the mind. A proposition is its expression in words.

A judgment consists of:

1. Subject.
2. Predicate.
3. Copula.

A proposition consists of:

1. } Two ideas.
2. }
3. Their mental relation.

To judge (in the psychological sense) is to:

1. Assert agreement or disagreement between two ideas.
2. Discover the relationship of two ideas.
3. Connect the two representations in a statement.

The result is a judgment:

Judgment acts upon the material submitted by either,

1. Preception or

2. Conception,

and may or may not be followed by

3. Formulation and expression

according to their complexity, judgments are either

1. Immediate or intuitive, or
2. Deliberate.

Comparison usually depends on memory; for in most cases one has to compare the memory of one thing with the impression produced by another; and if there is a third, its impressions are compared with the memory of those produced by the first and second. An exception may be where one compares the colors or degrees of brightness of two objects which are side by side, the weights of two objects held each in one hand. But in lifting two weights, one after the other, one must remember how heavy the first one was in order to compare the weight with that of the second one. Matching colors by memory certainly depends upon memory.

Subjective testing as claimed by the authorities in the preceding paragraphs and as we all know from experience, is dependent upon the examiner's *questions* and the consultant's *answers*. When a + 0.25 or a + 0.50 spherical or cylindrical lens is placed before the patient's eye, he is asked to determine whether the line of letters is clearer with or without this additional lens. Psychologically speaking, we call on our consultant in this case to compare the memory of the appearance of the image of the line of type as it appeared before and as it appears now with the added lens in the front of the eye, just the same as we would ask a person to compare the weight of two objects lifting first one, and then the other, and comparing the actual weight of the second object with the memory of that of the first object. In this case our patient is called upon to make use of the following attributes:

1. Concentration.
2. Attention.
3. Memory.

The three attributes mentioned are to be brought into use in order to make the comparison which will enable him to judge whether the letters were clearer before or after the lens was placed in the front of the eye.

The psychological process is the same no matter which way the question is framed by the examiner. It calls, in each case, for a positive or negative answer and the degree of accuracy of the answer is, in most cases, equal to the degree of the reliability of the consultant's judgment.

This has been my contention for many years and the results of our research carried on along this line bears out our contention. The research to determine the reliability of subjective findings was carried on along lines resembling as nearly as possible, the methods used generally in subjective testing.

Several hundred cases were used in this investigation. All of them were adults, none under eighteen years of age, and of more than ordinary intelligence, as part of this material used was made up of students of the Ohio State University who presented themselves at the eye clinic for refraction during my senior year, another part of the material is made up of soldiers and officers of the United States Army who called for refraction at United States Base Hospital Eye Clinic, with which the writer was connected during the war, and the last part of the material was taken from amongst patients of the writer's practice. The average age was 23 years.

The procedure was the same as followed out during a subjective test in the average refracting room.

(a) A + 0.25 D. Sph. was added to the patient's correction and he was asked whether this improved the line of type, made it worse, or made no change. A proper uniform notation was made for each answer.

(b) The next step was to place a + 0.25 D. Sph. in front of the corrected eye and after removing this, a lens of the same identical strength held in the other hand was placed in the front of the same eye and the question was again asked whether these lenses improved or blurred the type and if so, was the improvement or blur equal with both lenses or was it more pronounced with one than with the other. The proper and uniform notation made.

(c) A + 0.50 D. Sph. was next placed in the front of the corrected eye and the same procedure gone through as under (a).

(d) Next, a + 0.25 D. Sph. held in one hand and a + 0.50 D. Sph. in the other and the same procedure followed as in (b).

(e) A + 0.50 D. Sph. was held in one hand and a + 0.50 D. Sph. was held in the other hand and again the same procedure followed as in (b).

(f) Next, a + 0.50 D. Sph. and a + 0.75 D. Sph. was used and A + 0.75 D. Sph. and + 0.75 D. Sph. and the same procedure followed out as under (d) and (c). Care was taken in each case to put the question in a uniform way and to get a uniform answer and the proper notation made. To illustrate our point more clearly, we will cite the figures obtained from persons which are decidedly different in each case.

Name	Age	No.	Lens Power	Reliability of Judgment
J. S.	25	405	+ .25 D. Sph.	0
			+ .25 D. Sph.	S
			+ .50 D. Sph.	M
			+ .50 D. Sph.	2M
			+ .75 D. Sph.	3M
			+ .75 D. Sph.	4M

Here we find that by first holding A + 0.25 D. Sph. in front of

the corrected eye there appeared no difference in the line of type on the test chart (the 20th century test cabinet was used in all these tests) and accordingly zero (0) is entered in reliability of judgment column. Next two lenses each A + 0.25 D. Sph. is used and the consultant finds that one of them does not change the type in the least while the other makes some change and the letter S is entered in the last column designating some change.

Following this a + 0.25 D. Sph. and a + 0.50 D. Sph. was used. Here we find that there is a difference noted between the effect of each lens and while the first lens makes some (S) difference, the second lens makes more difference and the letter M is placed in the last column. 2M, 3M, and 4M are used to designate the consecutive increase in the amount of difference noted, that is, 4M means, that the second + 0.75 D. Sph. shows more difference than the first lens of the same power which is described by 3M.

The peculiarity in this case is, that while the consultant could tell the difference between two lenses of the *different powers* he, at the same time reported a difference in the two lenses of *equal power*.

Name	Age	No.	Lens Power	Reliability of Judgment
H. L. W.	25	495	+ .25 D. Sph.	0
			+ .25 D. Sph.	0
			+ .50 D. Sph.	0
			+ .50 D. Sph.	0
			+ .75 D. Sph.	0
			+ .75 D. Sph.	S

Here, in this case, he reports no difference at all during the first five trials and only notices some (S) difference with the last lens + 0.75 D. Sph.

Name	Age	No.	Lens Power	Reliability of Judgment
A. B. F.	27	295	+ .25 D. S.	S
			+ .25 D. S.	S
			+ .50 D. S.	M
			+ .50 D. S.	M
			+ .75 D. S.	2M
			+ .75 D. S.	2M

In this case the replies are 100% perfect and the consultant could tell the difference no matter how slight the change was. Cases of this type were very, very rare and the few that were found amongst the group were either draftsmen, architects, engineers and others who developed their power of judgment through training required in their special fields.

The results of this investigation which covered 520 cases are as follows:

Reliability of Judgment Table

Replies Tabulated From Experiment Report Sheets	No. of Cases	Pct.
(a) No difference noted when a + 0.25 D. Sph. was added	410 Cases or	79.5%
(b) Difference noted when a + 0.25 D. Sph. was added	110 " "	21.5%
(c) No difference noted between two + .25 D. Spheres	210 " "	40.0%
(d) Difference noted between two + 0.25 D. Spheres	310 " "	60.0%
(e) Difference noted between a + 0.25 D. Sph. and + 0.50 D. Sph.	300 " "	57.7%
(f) No difference noted between a + 0.25 D. Sph. and + 0.50 D. Sph.	220 " "	42.3%
(g) Difference noted between two + 0.50 D. Spheres	290 " "	55.7%
(h) No difference noted between two + 0.50 D. Spheres	230 " "	44.3%
(i) Difference noted between a + 0.50 D. Sph. and a + 0.75 D. Sph.	330 " "	61.3%
(j) No difference noted between a + 0.50 D. Sph. and a + 0.75 D. Sph.	190 " "	38.7%
(k) Difference noted between two + 0.75 D. Spheres	305 " "	58.7%
(l) No difference noted between two + 0.75 D. Spheres	215 " "	41.3%

Studying the reliability of judgment table we find that only 21.5% as given under (b) could detect a difference in the type when a + 0.25 D. Sph. was added, while 79.5% could not discern any difference at all, as given under (a). Again looking at (c) and (d) we find that only 40% of the patients could tell that there was no difference between two + 0.25 D. Spheres placed before the corrected eye consecutively while 60% reported a difference between two + 0.25 D. Spheres. That is, the test type appeared different through one than through the other. Under (e) and (f) we note that 57.7% could tell that there was some difference between a + 0.25 D. Sph. and a + 0.50 D. Sph. while 42.3% could find no difference at all. Again 55.7% found difference between two + 0.50 D. Spheres while 44.3% could tell no difference between these two lenses as under (g) and (h). Looking at (i) and (j) we find that 61.3% can tell a difference between a + 0.50 D. Sph. and a + 0.75 D. Sph. while 38.7% can not. Under (k) we find that 58.7% find a difference between two + 0.75 D. Spheres while 41.3% find them to be alike as under (l).

When cylinders were used during the experiment the findings were about the same as when the spheres were used.

That the differences, as reported here, are produced solely by faulty judgment and not brought about by an active accommodative condition was proven by the fact that over one hundred patients of the group used in this experiment had this test performed upon them first without a cycloplegic and next with use of a cycloplegic and we found the same discrepancies were reported in almost every case after as well as before the use of the cycloplegic.

The figures in the table alone speak for themselves. We fully realize that the subjective enthusiasts will think that they are too high, while the adherents of objective testing will think them to be too low, we feel however, that these figures are fairly accurate and would be even more so if this investigation would cover 5,000 or 10,000 cases. They give us a clear picture to what extent we can rely upon a subjective test from the standpoint of accuracy.

It has been repeatedly stated that the correction of the low spherical or cylindrical error are of the greatest importance. These certainly can not be found by the subjective test when we consider that 79.5% can not tell the difference when a + 0.25 lens is added to their correction.

Conclusion.

1. Subjective testing using the present accepted technic does not obtain accurate results.

2. That in most cases the error in the subjective findings will range from 40% to 60%.

3. That the degree of accuracy largely depends upon the patient's power of judgment.

4. That in order that the examiner may be able to correct the low errors of refraction it is of extreme importance that he become proficient in using the objective test and thus eliminate the personal equation which enters to a very great extent into the subjective test.

J. I. K.

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[2]Eyesight Survey and Service Lesson No. 3.
[3]"Psychology."—Ladd, p. 307.
[4]"A Text-Book of Psychology."—Ed. B. Titchener, pp. 540-546.
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[6]"Personal Efficiency."—Robert Grimshaw, pp. 163.

ANNOTATIONS AND SOCIETY PROCEEDINGS

The American Journal of Optometry is the official Organ of the American Academy of Optometry, as well as the Organ of the Arkansas, Delaware, Iowa, Maine, Maryland, Michigan, Minnesota, Nebraska, North Dakota, Oklahoma, Pennsylvania, South Dakota, Vermont and West Virginia Optometric Associations.

The following gentlemen have consented to supply items of interest from their respective sections, acting in the capacity of

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THE MICHIGAN CONVENTION

The 32nd annual convention of the Michigan Association of Optometrists was held October 9th, 10th and 11th at the Columbia Hotel at Kalamazoo, and is considered to be one of the most successful conventions of the Association.

The educational lectures proved to be very interesting and instructive, judging from the large attendance and the great interest displayed by the members.

The Association has gone on record to establish a Nelson K. Standart Foundation. The aim of this Foundation is to furnish financial assistance to aid worthy students to enter optometric colleges and study optometry. Also to give these graduates financial assistance and help them get started properly in their practice, until they are able to carry on for themselves. The committee to work out plans for this Foundation is composed of Dr. G. O. Ohlsson, Dr. Walter Springborg and Dr. Clifton DeGraff.

The proposition for the Michigan Optometric Association to withdraw from the A. O. A. was held over to be taken up at the February meeting of the Association to be held at Jackson. Flint was selected for the 1929 convention.

Among the many resolutions passed is one regarding Visual Surveys to the effect: "That the Michigan Society of Optometrists consider it unwise, unfair, unprofessional and unethical for any member of this society to conduct a visual survey in any town or city in which he or she has not an established office, unless such survey is made with the written consent and approval of a majority of the members

of the society in that town or city. Further that this society firmly disapprove of such survey work unless professional services are rendered according to the standards of this society."

The officers elected for the coming year are: President, Dr. Charles Van Sluyters, Grand Rapids; First Vice-President, Dr. G. C. Williams, Kalamazoo; Second Vice-President, Dr. Frank Fester, Detroit; Third Vice-President, Dr. Clifton DeGraff, Monroe; Fourth Vice-President, Dr. John Lowe, Grand Haven; Treasurer, Dr. Glenn C. Hill, Detroit; Secretary, Dr. Ernest Eimer, Muskegon.

The annual banquet, which was the outstanding social event, was held at the Columbia Hotel on Wednesday evening. Dr. G. O. Ohlsson acted as toastmaster. The dinner was followed by several interesting talks and a well arranged musical program.

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PENNSYLVANIA OPTOMETRIC CONVENTION

The thirty-second annual convention of the Pennsylvania Optometric Association was held October 1st to 3rd, at the William Penn Hotel at Pittsburgh. Dr. Morgan C. Davies, head of the Ohio State University School of Applied Optics, lectured on "Muscular Imbalances." Dr. Edwin F. Tait, member of the Pennsylvania State School of Optometry faculty, delivered a very interesting lecture on "Ocular Muscle Diagnosis as Used in the Interpretation of a New System of Dynamic Skiametry." Dr. Otto G. Haussmann lectured on "The Value of the Trial Case as a Subjective Method of Refraction." Mr. H. L. Johnston, director of the Department of Industrial and Commercial Lighting of the Duquesne Light Company, delivered two very interesting lectures on the "Illumination with Relation to Vision." Dr. H. D. Pearson spoke on "Focal Infection a Cause of Some Ocular Anomalies." Mr. A. E. Forshey spoke on "Fusion," and Mr. Scott Sterling discussed the value and intricacies of "Ophthalmic Lenses." Dr. Chester H. Johnson spoke on "Optometry" over the radio station WCAE. The convention concluded with a banquet on Tuesday evening at the William Penn Hotel.

The following were elected officers for the coming year: President, Dr. Albert M. McConnell, Pittsburgh; First Vice-President, Dr. George H. Huber, Lancaster; Second Vice-President, Dr. William J. Van Essen, Pittsburgh; Third Vice-President, Dr. J. C. Strauss, Allentown; Fourth Vice-President, Dr. Otto G. Haussmann, Philadelphia; Secretary, Dr. Harvey Clunk, Reading; Treasurer, Dr. F. L. Nungesser, Pittsburgh; Directors, Dr. J. K. Morris, Erie; Dr. John Martsch, Philadelphia; Dr. F. W. Hayes, Williamsport, and Dr. W. H. King, Chamberburg.

ORTHOGON -- AND A NEW